

ACC PROJECT 95-079T

# AIR COMBAT COMMAND



## Air Warfare Center

4370 North Washington Blvd, Suite 117  
Nellis AFB, Nevada 89191-7076

OC-135B OPEN SKIES  
(PHASE II UPGRADE)

QOT&E

DTIC QUALITY IMPROVED

INTERIM REPORT

AUGUST 1996

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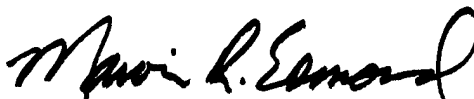
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13. ABSTRACT (Maximum 200 words)  This report contains the results of a preliminary assessment conducted as part of the qualification operational test and evaluation of the OC-135B Open Skies (Phase II Upgrade). The purpose of the assessment was to determine user satisfaction with the upgrade at its current stage of development. The assessment was conducted using an operationally representative training sortie planned by the On-Site Inspection Agency. The system program office is to use the results to maximize user satisfaction with the completed upgrade.				
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## EXECUTIVE SUMMARY

**1. OVERVIEW.** The 605th Test Squadron (TS) began the OC-135B Open Skies (Phase II Upgrade) Qualification Operational Test and Evaluation (QOT&E) with a preliminary assessment conducted in conjunction with an On-Site Inspection Agency (OSIA), Washington, DC, training sortie flown on 13 May 1996. Although the upgrade had not been certified as ready for dedicated QOT&E, the mission presented an opportunity to assess user satisfaction with the upgrade at its current stage of development and provide feedback to the system program office (SPO). The mission was planned by the OSIA to be demanding of both crew and equipment. All sensors were used except the Synthetic Aperture Radar (SAR). At the time of the sortie, integration of the SAR into the OC-135B configuration was incomplete. The 10.4-hour mission involved numerous and frequent changes in observation parameters, such as aircraft heading, speed and altitude, combinations of sensors, optical filters, and image recording media. **Questionnaire responses from crew members indicated a high degree of overall satisfaction with the upgrade even under operating conditions that exceeded those expected on a typical Open Skies observation mission.** However, crew members recommended 24 improvements (17 to eliminate mission-degrading deficiencies and 7 enhancements). The most significant of these was for the addition of a Data Annotation, Recording, and Mapping System (DARMS) display at the flight-following station for use by the deputy mission commander (DMC) and flight monitor. The display is considered essential to keeping the workload manageable and in maintaining situation awareness (SA) at the station. This interim report addresses this first QOT&E effort only. A final report, which will be published after the completed Phase II upgrade is tested, will supersede this interim report. The completed Phase II upgrade will be tested after it is certified as ready for dedicated QOT&E.

**2. BACKGROUND.** The Under Secretary of Defense for Acquisition directed the Air Force to equip, operate, and maintain aircraft to implement the Treaty on Open Skies, 24 March 1992. In response, three WC-135B aircraft are being modified and redesignated as the OC-135B. Phase I of the modification was completed in 1993 and provided a one-aircraft initial operational capability. Phase II is an upgrade that will provide a two-aircraft full operational capability. The OC-135B is operated and maintained by the Air Combat Command. Mission crew members consist of both 45th Reconnaissance Squadron, Offutt AFB, Nebraska, and OSIA personnel. The Air Force Operational Test and Evaluation Center completed operational testing of the Phase I system in 1993, and the 418th Flight Test Squadron, Edwards AFB, California, is nearing completion of engineering testing of the Phase II system. During a program review meeting at Wright-Patterson AFB, Ohio, on 10 May 1996, the OSIA asked the 605 TS to

perform a preliminary assessment as the first QOT&E event on the Phase II upgrade. The SPO agreed that a preliminary assessment would be beneficial to the acquisition program.

**3. DESCRIPTION.** The OSIA will use the OC-135B to deploy worldwide and perform high- and low-altitude observation missions over countries that have ratified the Treaty on Open Skies. The Phase II upgrade includes the addition of an Infrared Line Scanner (IRLS), SAR, video cameras, a DARMS, new media storage containers, and a new internal Auxiliary Power Unit (APU). Also included in the upgrade are Inertial Navigation System, Global Positioning System, and Combined Altitude Radar Altimeter (CARA) equipment changes; larger optical windows; and various internal equipment modifications to support sensor integration.

#### **4. RESULTS.**

**a. Overall.** At this point in the modification, there is a high level of satisfaction with the upgrade. Crew members praised the mission commander (MC) station, DARMS, CARA, and 115-VAC power outlets as noteworthy improvements. However, they also recommended improvement in 17 areas (identified in paragraph 4b) which presently degrade mission accomplishment and 7 areas which, if modified, would enhance mission task performance.

##### **b. By Objective.**

**(1) Internal APU.** A total of seven crew members were questioned about APU ground operations. Of these, three were satisfied, one was undecided, and three were dissatisfied. The main reasons cited for dissatisfaction were uncontrolled APU shutdown for no apparent reason and operator-controlled shutdown because of excessive APU exhaust gas temperature.

**(2) Optical Filter Changes.** A total of three sensor maintenance technicians (SMTs) were questioned about the filter change process. Of these, one was very satisfied, one was satisfied, and one was dissatisfied. The main reason cited for dissatisfaction was the speed/contrast switch on the KS-87E Framing Camera could not be adjusted without removing the camera magazine.

**(3) CARA Operation by the Pilot, Copilot, Navigator, and DMC.** A total of eight crew members were questioned about CARA operability. Of these, seven were very satisfied and one was satisfied; however, one problem was identified. The pilot's display constantly indicated an altitude 200 feet lower than the copilot's display.

**(4) Flight-Following Station Displays.** A total of five crew members were questioned about the displays. Of these, four were dissatisfied and one was very dissatisfied. The main reason cited for dissatisfaction was the difficulty in maintaining adequate and timely SA without a DARMS display at the station. Additionally, crew members strongly recommended a magnetic heading display to improve SA and a keyboard to allow access to information stored in the DARMS data base. The DARMS and magnetic heading displays and keyboard are needed to reduce the DMC workload and facilitate coordination with onboard representatives of the country being observed.

**(5) Sensor Suite Operation From the Sensor Operator (SO) Station.** A total of three linguist sensor operators (LSOs) were questioned about sensor suite operability. Of these, one was satisfied and two were dissatisfied. The main reasons cited for dissatisfaction were as follows:

(a) The DARMS inaccurately displayed KS-87E and KA-91C Panoramic Camera status. When the cameras were operating, RDY was displayed.

(b) The vertical-looking video camera has a variable focal length which cannot be set to a treaty mandated height/minimum.

(c) The location of the video control unit results in physical interference between operating the video controls and performing other LSO tasks.

(d) An erroneous default value is programmed into the system for both oblique-mounted KS-87Es.

**(6) MC Station Displays.** A total of two MCs were questioned about the displays. Of these, one was very satisfied and one was satisfied; however, they also observed the inaccurate DARMS display of KS-87E and KA-91C status.

**(7) Onboard Media Storage Equipment.** A total of three SMTs were questioned about the equipment. Of these, two were satisfied and one was undecided; however, one problem was identified. It was difficult to close the media cooler covers quickly and tightly because the insulation interfered with closure.

**(8) Media Processing.** A time log was kept on media processing activity from receipt of the media at the processing facility to availability of the finished products. Media processing was completed in 44 hours. This met the user requirement.

(9) **Reliability, Maintainability, and Availability (RMA).** A total of three SMTs were questioned about RMA. The most significant problems identified were as follows:

- (a) The IRLS magazine guide rails are missing from the unit.
- (b) The KS-87E film magazine cassettes are old and badly worn.
- (c) The communications boxes at the SMT seat positions were malfunctioning.
- (d) There are not enough KS-87E film magazine cassettes.
- (e) The IRLS shockmounts may be too soft.

#### **5. Preliminary Conclusions.**

- a. The Phase II upgrade of the Open Skies OC-135B appears to be on track in satisfying user needs.
- b. The identified mission-degrading deficiencies must be corrected to enable the Phase II upgrade to fully support the Open Skies observation mission.

#### **6. Preliminary Recommendations.**

- a. Expeditiously correct the identified mission degrading deficiencies.
- b. Continue operational testing of the OC-135B Open Skies Phase II upgrade as the aircraft becomes available.



## TABLE OF CONTENTS

COVER  
TITLE AND SIGNATURE PAGE  
SF 298, REPORT DOCUMENTATION PAGE

	Page
EXECUTIVE SUMMARY.....	i
TABLE OF CONTENTS.....	v
TABLES.....	vii
ABBREVIATIONS.....	ix

### SECTION 1 - INTRODUCTION

1.1	PURPOSE.....	1-1
1.2	AUTHORITY.....	1-1
1.3	BACKGROUND.....	1-1
1.4	SYSTEM DESCRIPTION.....	1-2
	1.4.1 Sensor Suite.....	1-2
	1.4.2 CARA.....	1-5
	1.4.3 Voice SATCOM.....	1-5
	1.4.4 Internal APU.....	1-5
	1.4.5 Media Storage.....	1-5
	1.4.6 Additional System Changes.....	1-5
1.5	OPERATIONAL CONCEPT.....	1-5
	1.5.1 Threat.....	1-6
	1.5.2 Employment.....	1-6
	1.5.3 Support.....	1-6
1.6	SCOPE.....	1-6
	1.6.1 Planning Considerations.....	1-6
	1.6.2 Objectives.....	1-7
	1.6.3 Limiting Factors.....	1-7
1.7	KEY PERSONNEL.....	1-8

### SECTION 2 - RESULTS

2.1	GENERAL PROCEDURE.....	2-1
2.2	RESULTS BY OBJECTIVE.....	2-3
	2.2.1 Objective 1 (APU).....	2-3
	2.2.2 Objective 2 (Optical Filters).....	2-5
	2.2.3 Objective 3 (CARA).....	2-6
	2.2.4 Objective 4 (Flight-Following Station Displays).....	2-7
	2.2.5 Objective 5 (Sensor Suite).....	2-9
	2.2.6 Objective 6 (Mission Commander Station Displays).....	2-12

## TABLE OF CONTENTS (CONTINUED)

	Page
2.2.7 Objective 8 (Media Storage).....	2-13
2.2.8 Objective 9 (Media Processing).....	2-15
2.2.9 Objective 10 (RMA).....	2-16
2.3 PRIORITIZED DRs.....	2-17
2.3.1 Prioritization.....	2-17
2.3.2 Impact Summary.....	2-17
2.4 OVERALL ASSESSMENT.....	2-17

### SECTION 3 - CONCLUSIONS AND RECOMMENDATIONS

3.1 PRELIMINARY CONCLUSIONS.....	3-1
3.1.1 Overall.....	3-1
3.1.2 By Objective.....	3-1
3.2 PRELIMINARY RECOMMENDATIONS.....	3-2

### DISTRIBUTION

## TABLES

Table	Page
1-1 Key Personnel.....	1-9
2-1 Mission-degrading Deficiencies.....	2-18
2-2 Recommended Enhancements.....	2-18

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## ABBREVIATIONS

ACC.....Air Combat Command  
 AFE.....analog front end  
 AGL.....above ground level  
 APU.....auxiliary power unit  
 CARA.....combined altitude radar altimeter  
 DARMS.....data annotation, recording, and mapping system  
 DMC.....deputy mission commander  
 DR.....deficiency report  
 DSS.....digital subsystem  
 DT&E.....development test and evaluation  
 EGT.....exhaust gas temperature  
 EO.....equipment operability  
 FLTS.....flight test squadron  
 FLV.....forward-looking video  
 FM.....flight monitor  
 FOC.....full operational capability  
 GPS.....global positioning system  
 INS.....inertial navigation system  
 IOC.....initial operational capability  
 IPLAN.....implementation plan  
 IRLS.....infrared line scanner  
 LED.....light emitting diode  
 LSO.....linguist sensor operator  
 MC.....mission commander  
 mm.....millimeter  
 OC-ALC.....Oklahoma City Air Logistics Center  
 OCR.....office of collateral responsibility  
 OPR.....office of primary responsibility  
 OSIA.....On-Site Inspection Agency  
 OSMFP.....Open Skies Media Processing Facility  
 QOT&E.....qualification operational test and evaluation  
 QT&E.....qualification test and evaluation  
 RDU.....remote display unit  
 RMA.....reliability, maintainability, and availability  
 RS.....reconnaissance squadron  
 SA.....situation awareness  
 SAR.....synthetic aperture radar  
 SATCOM.....satellite communications  
 s/c.....speed/contrast  
 SMT.....sensor maintenance technician  
 SO.....sensor operator  
 SPO.....system program office  
 TMT.....test management team  
 TS.....test squadron  
 v/h.....velocity/height  
 VLV.....vertical-looking video  
 Z.....Zulu

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## **SECTION 1 - INTRODUCTION**

### **1.1 PURPOSE.**

**1.1.1** The Air Warfare Center/53d Wing/505th Command and Control Evaluation Group/605th Test Squadron (TS) conducted a preliminary assessment of the OC-135B Open Skies (Phase II Upgrade) in conjunction with a training sortie planned and executed by the On-Site Inspection Agency (OSIA), Washington, DC, and the 45th Reconnaissance Squadron (RS), Offutt AFB, Nebraska. Although the upgrade had not been certified as ready for dedicated qualification operational test and evaluation (QOT&E), the sortie provided an opportunity for early user involvement in the QOT&E process. The purpose of the assessment was to determine user satisfaction with the upgrade at its current stage of development and give feedback to both the user and developer. The results are to be used by the system program office (SPO) (Oklahoma City Air Logistics Center (OC-ALC)/LCRE, Tinker AFB, Oklahoma) to maximize user satisfaction with the completed upgrade. This interim report addresses this first QOT&E effort only. A final report, which will be published after the completed Phase II upgrade is tested, will supersede this interim report. The completed Phase II upgrade will be tested after it is certified as ready for dedicated QOT&E.

**1.1.2** The sortie was flown on 13 May 1996. It originated at Wright-Patterson AFB, Ohio, spanned 10.4 hours, and terminated at Offutt AFB. Mission activity was concentrated over the southeastern US.

**1.2 AUTHORITY.** HQ Air Force Program Management Directive 2343(1), C/KC-135 Aircraft Integrated Weapon System Management, 27 January 1994, and HQ ACC Project Order 95-079T, OC-135B Open Skies Qualification Operational Test and Evaluation, 25 September 1995, directed the QOT&E. The project has precedence equal to operational training and director of operations commitments. It is Number 30 on the Air Combat Command (ACC) FY96 OT&E/TD&E Priority List.

### **1.3 BACKGROUND.**

**1.3.1** The Under Secretary of Defense for Acquisition directed the Air Force to equip, operate, and maintain aircraft to implement the Treaty on Open Skies, 24 March 1992. In response, the Air Force is modifying three WC-135B aircraft to conform to the treaty. The modification is being accomplished in three phases: Phase I was completed in 1993 and provided a one-aircraft (Number 2674) initial operational capability (IOC); Phase II is an upgrade which will provide a two-aircraft (Numbers 2670 and 2672) full operational capability (FOC); and Phase III will be a retrofit of selected elements of the Phase II upgrade to Aircraft 2674. After the retrofit, Aircraft 2674 will be used to support training. The modified aircraft have been

redesignated as the OC-135B and are capable of deploying worldwide and performing high- and low-altitude unarmed observation missions over countries that have ratified the Treaty on Open Skies.

**1.3.2** The Air Force Operational Test and Evaluation Center completed QOT&E of the Phase I IOC-configured OC-135B in 1993. The QOT&E was conducted after development test and evaluation (DT&E) of the aircraft. Results are documented in Open Skies Test Report 4950-FTR-93-02, 22 December 1993.

**1.3.3** The 418th Flight Test Squadron (FLTS), Edwards AFB, California, is conducting a combination DT&E and qualification test and evaluation (QT&E) of the Open Skies Phase II upgrade. Air-worthiness testing of the OC-135B with the upgrade has been completed. The remaining DT&E and QT&E will ensure the aerial observation capabilities are in accordance with the Treaty on Open Skies. Objectives address compliance with treaty technical requirements and functionality of Open Skies systems. The SPO will certify the Phase II upgrade as ready for dedicated QOT&E when DT&E and QT&E are completed. A detailed description of the 418 FLTS-conducted testing is contained in Open Skies Test Plan, ASC/AM-94-09-01, 31 August 1995.

**1.3.4** On 10 May 1996, the SPO convened a program review meeting at Wright-Patterson AFB to discuss open service reports submitted by DT&E and QT&E testers and make a decision regarding 605 TS participation in two planned training sorties. After lengthy discussion involving all stake holders, the group consensus was that 605 TS participation would be a value-added effort. During the group discussion, 605 TS test team members pointed out their primary thrust would be to identify deficiencies and enhancements and submit deficiency reports (DRs) according to TO 00-35D-54. Weather conditions and a full aircraft schedule resulted in only one of the two planned training sorties being flown.

**1.4 SYSTEM DESCRIPTION.** The OC-135B Open Skies modification involves the sensor suite, AN/APN-232(V) Combined Altitude Radar Altimeter (CARA), voice satellite communications (SATCOM), internal Auxiliary Power Unit (APU), and media storage.

**1.4.1 Sensor Suite.** The sensor suite consists of three KS-87E Framing Cameras; one KA-91C Panoramic Camera; one AN/AAD-5(RC) Infrared Line Scanner (IRLS); one AN/APD-14 Synthetic Aperture Radar (SAR); two video cameras; and a Data Annotation, Recording, and Mapping System (DARMS).

**1.4.1.1 KS-87E.** There are three KS-87Es mounted in the camera bay compartment--one is mounted vertically and two are mounted obliquely. The oblique cameras are mounted one on each side of the aircraft viewing opposite sides of the flight path. The vertical KS-87E has a 3-inch (76-millimeter (mm)) focal length



lens as primary and a 6-inch (152-mm) lens as secondary. The oblique KS-87Es have a 6-inch focal length lens as primary and a 3-inch lens as secondary. The three cameras use SO-050, 3404, or 3412 film. Although the cameras can accept multiple filter types, the Treaty allows only Wratten 12 (yellow) and Wratten 25 (red) filters to be used. Operationally, the KS-87Es are used for low-altitude flights. The overlap of any given series of photographs taken by a KS-87E is selectable from the camera control panel.

**1.4.1.2 KA-91C.** There is one KA-91C mounted vertically in the camera bay compartment. The KA-91C uses an 18-inch focal length lens with a prism that scans across the line of flight. The field of view is selectable from the camera control panel. The KA-91C also uses SO-050, 3404, or 3412 film. Although the cameras can accept multiple filter types, only Wratten 12 and Wratten 25 filters are used. Operationally, the KA-91C is used for high-altitude flights. The overlap of any given series of photographs taken by the KA-91C is selectable from the camera control panel.

**1.4.1.3 IRLS.** The IRLS is intended to provide a high-resolution map (in a panoramic format) of the terrain being transversed by the aircraft. The system consists of six components: The control panel, receiver, power supply, recorder, film magazine, and infrared performance analyzer. The control panel is located at the sensor operator (SO) station. The receiver is located just forward of the optical cameras. The remaining units are located on a metal plate aft of the APU. At the time of the training sortie, the IRLS had not been treaty certified.

**1.4.1.4 SAR.** The SAR is an airborne side-looking, day/night, all-weather sensor that consists of a modified AN/UPD-8 Analog Front End (AFE) and a digital subsystem (DSS). The sensor was modified to remove outdated technologies, improve maintainability, and meet treaty requirements. The AFE performs the transmit and receive functions generating the high-power transmit pulse as well as various timing and demodulation signals necessary to produce the video returns. The DSS samples the video returns, applies motion compensation, and reduces the data bandwidth to meet treaty requirements. It then records the data to tape along with the treaty-required annotation data supplied by the DARMS. The DSS also provides the command and control interface to the sensor. AFE and DSS components are located in an equipment rack and are cooled through a system of ducts by an air-conditioner located directly aft of the rack. The components are connected via an optical data link to a very large data store recorder located in the DARMS rack. The antenna assembly is located on the bottom of the aircraft in conformal fairing. The waveguide from the equipment rack to the antenna is pressurized with nitrogen. The antenna is steered and positioned by a

hydraulic system that uses aircraft hydraulic pressure. At the time of the training sortie, integration of the SAR into the OC-135B configuration was incomplete.

**1.4.1.5 Video Cameras.** There are two video cameras--one is vertical looking and the other is forward looking. The vertical-looking video (VLV) camera is mounted in the camera bay and shares the optical window with the KA-91C. The forward-looking video (FLV) camera is mounted near the nose of the aircraft, looks forward and down 33 degrees from horizontal, and uses an optical window similar to those in the camera bay. Each camera is equipped with a motorized zoom lens that has a focal length of from 7.3 to 102.0 mm. Operation of each camera and lens is remotely controlled by the video control unit and an individual RC-C10 Remote Control Box. Information from each camera can be displayed on a 13-inch monitor at the SO station and a 19-inch monitor located across from the mission commander (MC) station. Both monitors have a front panel switch to allow viewing either the VLV or the FLV. Imagery from the VLV camera can be recorded on a 1/2-inch Super Video Home System magnetic tape. DARMS provides data annotation information for every frame of VLV as well as header and footer information for each magnetic tape cassette. Imagery from the FLV camera cannot be recorded. At the time of the training sortie, the VLV camera had not been treaty certified.

**1.4.1.6 DARMS.** The DARMS consists of a data annotation control unit; a computer workstation with keyboard; an uninterruptible power supply; and two high-resolution, 16-inch monitors. The primary function of DARMS is to provide media annotation in accordance with treaty requirements. In addition, a moving-map display and various parameters, such as date, Universal Time Constant/Coordinated Universal Time, altitude above ground level (AGL), heading, ground speed, latitude, longitude, and time to next waypoint, are displayed throughout a mission. The DARMS provides velocity/height (v/h) calculations to the camera control system for timing the overlap and motion compensation of the images. The v/h ratio is calculated from the velocity received from the Inertial Navigation System (INS) combined with the altitude received from the CARA. The DARMS provides a computer log of various events. It continuously records (at a user-selected rate) navigation and flight data being received from the INS, Global Positioning System (GPS), CARA, and sensor operation activities. These data are used to produce a mission report once the mission is completed. The DARMS provides the capability for real time monitoring and display of sensor coverage and navigational tracking of the aircraft. The system provides the capability to process navigation and sensor data for display on a moving map, the actual navigation path, actual sensor events, planned navigation path, planned sensor events, and other pertinent mission information. The DARMS also provides altitude and INS state-of-health information to the SAR. The INS

parameters are used to monitor the quality of the motion measurements. The altitude is used to set the initial reference altitude for the SAR when the SAR is operated.

**1.4.2 CARA.** The CARA indicates aircraft altitude AGL. The control indicator displays absolute altitude from 0 to 50,000 feet. On Aircraft 2670 and 2672, the CARA has two radar altimeter systems. Each system has one RT-1438 receiver-transmitter, one AS-3644 antenna assembly, two control indicators, and one signal data converter. A radar altimeter junction box interconnects the two systems to the pilot and copilot flight director/rotation go-around systems and to a step relay. Two radar altimeter switches at the flight-following station control the step relay. With the switches, the deputy mission commander (DMC) selects the system that supplies altitude information to the DARMS.

**1.4.3 Voice SATCOM.** Voice SATCOM capability is provided by the AN/ARC-187 Ultrahigh Frequency Radio Set. The radio can transmit with 30 watts when used in the amplitude modulation mode or 100 watts when used in the frequency modulation mode. The control head is located at the navigator station. Voice SATCOM is primarily for use by the aircrew.

**1.4.4 Internal APU.** The APU is located on the left side of the cargo floor just forward of the camera bay compartment. The APU is for ground use only and provides engine start, cabin heat, and electrical power during ground operations. The electrical power is used to operate all aircraft and Open Skies systems without the aid of external support equipment.

**1.4.5 Media Storage.** Portable coolers are being used to satisfy onboard media storage requirements. Each of these seven coolers can hold up to eight film canisters and four cassettes. Temperature requirements are being met by using the refrigeration units included in the coolers. When required, warming media to operating temperature is done with commercial off-the-shelf thermal blankets in an electrically heated insulated box. The box can hold up to 10 rolls of film and 3 cassettes.

**1.4.6 Additional System Changes.** The Phase II upgrade also includes INS, GPS, and CARA equipment changes; larger optical windows; and various internal equipment modifications to support sensor integration.

**1.5 OPERATIONAL CONCEPT.** The operational concept for the OC-135B is summarized in the HQ ACC Open Skies Implementation Plan (IPLAN), 1 February 1995. The IPLAN was developed from the Treaty on Open Skies.

**1.5.1 Threat.** Open Skies missions are flown with the permission of the country being observed. The overall objective of the treaty is to promote openness between signatories. Therefore, a threat intended to counter or disable this system is not anticipated.

**1.5.2 Employment.** The Open Skies observation mission begins no earlier than 24 hours after the arrival of the OC-135B at an Open Skies airfield. The mission is flown anywhere within the country being observed along an approved flight path. A mission profile consists of numerous cruise and descent to observation area (and repeat) segments with an overall range dependent upon the nation being overflown. Imaging with the optical camera, IRLS, SAR, and video sensors is done according to an approved mission plan. Exposed film is placed in individual containers, sealed as soon as practical after being removed from the camera magazine, and annotated according to the Treaty on Open Skies. The exposed film is processed in an Open Skies-approved processing facility.

**1.5.3 Support.** The OC-135B is intended to be capable of operating independently of unique support equipment for periods of up to 2 weeks. Logistics support during an Open Skies mission primarily consists of organizational-level maintenance provided by two dedicated crew chiefs and six additional maintenance personnel on board the aircraft. Required depot-level maintenance and modifications are coordinated through 12th Air Force and HQ ACC functional managers and performed by Air Force Materiel Command or contract maintenance, as appropriate. Limited off-equipment repair for the KS-87E and KA-91C is performed at Offutt AFB. Similar support is planned for the IRLS, SAR, and video cameras when the aircraft reaches FOC.

**1.6 SCOPE.** The training sortie was planned by OSIA to be operationally representative of a demanding Open Skies mission. The OSIA mission plan required extensive use of onboard systems during the sortie to create a heavier than usual crew workload. Observation media collected during the sortie were processed in the Open Skies Media Processing Facility (OSMPF), Wright-Patterson AFB. Overall, these activities supported an operationally meaningful preliminary assessment of user satisfaction.

#### **1.6.1 Planning Considerations.**

**1.6.1.1** The preliminary assessment was planned with regard to the stage of development of the upgrade and the opportunity for input to the development process. Overall, the upgrade was considered to be mature enough to support a preliminary assessment but not a comprehensive evaluation. The goal was early identification of problem areas so that corrections could be integrated with the remaining engineering and fabrication effort.

**1.6.1.2** The most realistic and cost-effective method of completing the preliminary assessment was through data collection during an operationally representative training sortie. In this way, training goals and assessment objectives were addressed simultaneously using the same resources.

**1.6.2 Objectives.** The preliminary assessment was intended to address the following objectives.

**1.6.2.1 Objective 1.** Assess the capability of the internal APU to support OC-135B ground operations without the aid of external support equipment.

**1.6.2.2 Objective 2.** Assess the capability of the KS-87E and KA-91C to accommodate optical filter changes.

**1.6.2.3 Objective 3.** Assess the capability of the CARA to be operated by the pilot, copilot, navigator, and DMC.

**1.6.2.4 Objective 4.** Assess the capability of displays available at the flight-following station to present flight information to the DMC and flight monitor (FM).

**1.6.2.5 Objective 5.** Assess the capability of the sensor suite to be operated from the SO station.

**1.6.2.6 Objective 6.** Assess the capability of displays available at the MC station to present mission information to the MC and other observers.

**1.6.2.7 Objective 7.** Assess the capability of the ARC-187 to be operated from the navigator station.

**1.6.2.8 Objective 8.** Assess the capability of onboard storage and temperature conditioning equipment to maintain and prepare recording media for use.

**1.6.2.9 Objective 9.** Assess the timeliness of recorded media processing.

**1.6.2.10 Objective 10.** Assess the reliability, maintainability, and availability (RMA) of the sensor suite equipment and internal APU.

**1.6.2.11 Objective 11.** Assess the accessibility of the forward fuel cell.

### **1.6.3 Limiting Factors.**

**1.6.3.1** At the time of the training sortie, integration of the SAR into the OC-135B configuration was incomplete. This prevented operation of the SAR during the sortie.

1.6.3.2 Although the IRLS and VLV camera were used during the training sortie, they were not treaty certified at the time of the sortie due to unresolved problems with image quality.

1.6.3.3 The ARC-187 was not operated during the training sortie; therefore, Objective 7 could not be accomplished. There was no requirement for voice SATCOM use in the OSIA mission plan.

1.6.3.4 At the time of the training sortie, technical data and training had not been completed. Therefore, maintenance personnel including the sensor maintenance technicians (SMTs) had accumulated little experience in maintaining the Open Skies equipment.

1.6.3.5 The single training sortie provided insufficient equipment operating time to support calculation of meaningful numeric RMA values.

1.6.3.6 Although operator proficiency appeared high during the training sortie, some operators had not completed specific training on some equipment items.

1.6.3.7 At the time of the training sortie, maintenance personnel had accumulated no experience in accessing the forward fuel cell after the SAR was installed. This prevented accomplishment of Objective 11.

1.6.3.8 The training sortie was not conducted under cold weather conditions, such as may be encountered on operational Open Skies missions.

1.7 **Key Personnel.** Table 1-1 provides a list of personnel who had responsibilities essential to planning, supporting, conducting, and reporting this preliminary assessment.

Table 1-1. Key Personnel

Title	Name	Organization	DSN
Project Officer	Maj Pillet	HQ ACC/DRFR	574-7434
Project Officer	Maj Panting	HQ ACC/DOYR	574-7982
QOT&E Project Manager	Capt Swentkofske*	605 TS/TST	872-5361
Alternate Project Manager	SMSgt Palumbo*	605 TS/TST	872-5361
Operations Analyst	Mr. Siedow*	605 TS/CCT	872-4671
Unit Project Officer	Lt Col Beaty	45 RS/DOF	271-7979
Unit Project Officer	Lt Col Simmons	OSIA	364-4235
Unit Project Officer	Mr. Grieshop	OSMPF	787-3844
Open Skies Program Manager	Mr. Price	OC-ALC/LCRE	336-5845
DT&E/QT&E Project Manager	Maj Fritz	ASC/AMA	787-2668
TMT DR Monitor	TSgt Meadows	605 TS/TSH	872-4671
TMT Editor	Ms. Hart*	605 TS/CC	872-5311
TMT Secretary	Mrs. Broxson*	605 TS/TST	872-5361
<b>LEGEND:</b> ASC is Aeronautical Systems Center. DR is Deficiency Report. DSN is Defense Switched Network. TMT is test management team.			
* TMT members.			

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## SECTION 2 - RESULTS

**2.1 GENERAL PROCEDURE.** The OSIA planned the training sortie to be workload intensive. Their intent was to positively stress the system and operators through an extended duration sortie with multiple flight and sensor parameter changes. The sortie was the most extensive operational wring-out of the upgraded OC-135B to date. Flight crew members and SMTs were from the 45 RS. Mission crew members were from the OSIA.

**2.1.1** The OC-135B took off from Wright-Patterson AFB at 1312 Zulu (Z) on 13 May 1996. The first sensor pass was over resolution targets in the vicinity at 1325Z. The aircraft then headed toward the southeastern US. When in the operational area designated by the mission plan, the aircraft made multiple sensor passes. Initial passes occurred over South Carolina and the southeastern portions of North Carolina concentrating on military and cultural targets along the eastern seaboard and inland areas. The mission plan then directed the aircraft to the immediate north to make sensor passes over military installations in Virginia. Following multiple passes over Virginia, the aircraft headed north over Maryland, Delaware, and Pennsylvania en route to a planned landing at Wright-Patterson AFB. Sensors were operated at a heightened tempo during each pass. They were on almost continuously from 1400Z to 2100Z. In all, 47 separate sensor events occurred. The mission plan had almost been completed when the cockpit outer windscreen developed a crack. This caused the aircraft to be diverted to Offutt AFB. Touchdown time at Offutt AFB was 2338Z for a total mission time of 10.4 hours.

**2.1.2** Each sensor except the SAR was used during the sortie. The three KS-87Es imaged multiple cultural and military targets at altitudes ranging from 2,810 feet AGL to 6,300 feet AGL. Several filter, film type, and magazine changes were made during the sortie. The KS-87Es exposed six rolls of film resulting in approximately 6,000 feet of imagery--2,000 feet from each camera. The KA-91C imaged multiple cultural and military targets at altitudes ranging from 12,000 feet AGL to 16,000 feet AGL. Several magazine changes were made during the sortie. The KA-91C exposed nine rolls of film. The IRLS imaged multiple cultural and military targets at altitudes throughout the sortie flight envelope. Only two magazine changes were made during the sortie. The IRLS exposed two rolls of film.

**2.1.3** To maximize training, OSIA and the 45 RS rotated personnel on each duty position. This also benefited the assessment by providing more than one questionnaire respondent for each duty position.

2.1.3.1 Each linguist SO (LSO) completed an extensive set of tasks which included updating inputs to the DARMS, informing the DMCs of sensor on and off time, logging all sensor events, and updating weather information for each sensor pass.

2.1.3.2 Each SMT also completed an extensive set of duties which included multiple filter changes between sensor runs, adjusting the speed/contrast (s/c) switch for each filter change, reloading film cassettes and magazines, logging film use, and storing exposed film.

2.1.3.3 Each DMC's workload was heavy. Flight monitoring included the tasks of following the aircraft flight path and altitude, identifying obstructions, directing actions to execute the mission plan and coordinating course, and other navigational changes resulting from air traffic control direction and weather.

2.1.3.4 Each MC oversaw the entire observation effort. This included monitoring flight and sensor activity, directing all mission related tasks, and ensuring crew coordination.

2.1.4 The TMT collected data throughout the sortie by observing crew activity and equipment performance and administering questionnaires. TMT members used logbooks and photographic and video equipment to record their observations. Each crew member completed a questionnaire on each duty position occupied during the sortie. In addition, the TMT collected copies of pertinent flight logs at the end of the sortie and recorded information revealed at the debriefing sessions. TMT members then validated and consolidated the data from the various sources to form a data base for analysis and assessment.

2.1.5 TMT members analyzed and assessed the Open Skies Phase II upgrade with respect to the stated objectives. In addition, TMT members prepared and submitted DRs to OC-ALC/LCRE for resolution and action.

## **2.2 RESULTS BY OBJECTIVE.**

**2.2.1 Objective 1.** Assess the capability of the internal APU to support OC-135B ground operations without the aid of external support equipment.

**2.2.1.1 Measure.** Flight, mission, and maintenance crew member judgment of the sufficiency of engine starting, cabin heating, and electrical power during ground operations without the aid of external support equipment.

**2.2.1.2 Procedure.** The APU was used to provide cabin heat and engine start during ground operations in preparation for the training sortie. A TMT member observed the activity and administered a questionnaire to each participating crew member.

**2.2.1.3 Findings.** A total of seven crew members participated in ground operations and completed the questionnaire. Of these, three were satisfied and three were dissatisfied with the capability; one was undecided. The reasons for dissatisfaction were two problem areas identified as mission-degrading deficiencies. These deficiencies and enhancements recommended by the crew members are as follows:

**2.2.1.3.1 Deficiency: APU Premature Shutdown (DR FA4521960005).** The APU shuts down for no apparent reason usually during engine start. Since the OC-135B must operate from austere airfields in remote locations, proper function of the APU is essential to mission completion.

**2.2.1.3.2 Deficiency: APU Runs Too Hot (DR FA4521960006).** The APU exhaust gas temperature (EGT) exceeded acceptable limits and the APU had to be shutdown until the EGT decreased. The APU was then restarted and used to start the aircraft engines without incident. Since the OC-135B must operate from austere airfields in remote locations, proper function of the APU is essential to mission completion.

**2.2.1.3.3 Enhancement: Excessive Airflow Noise at High Heat Settings (DR FA4521960021).** When the APU was used to provide cabin heat, the high heat settings produced a very irritating roar in the aircraft heating air ducts. Although required communications were conducted with the roar present, completion of mission tasks would be more convenient and crew comfort would be improved if the roar was eliminated or attenuated.

**2.2.1.3.4 Enhancement: Navigator Station Does Not Have a Bleed Air Light (DR FA4521960022).** The navigator is the crew member responsible for informing the pilot when bleed air is sufficient to start the engines. The current configuration has only APU ON (operating) and APU RDY (ready to load generator) indications at the navigator station. This impacted crew coordination on engine

start. Although the task was completed using current methods, the process would be more convenient if a gauge or light was provided.

**2.2.1.4 Conclusion.** The capability of the internal APU must be improved to fully support OC-135B ground operations.

**2.2.1.5 Recommendation.** Correct the mission-degrading deficiencies identified by DRs FA4521960005 and FA4521960006 and provide the enhancements identified by DRs FA4521960021 and FA4521960022 (Office of Primary Responsibility (OPR): HQ ACC/DRFR; Office of Collateral Responsibility (OCR): HQ ACC/DOYR).

**2.2.2 Objective 2.** Assess the capability of the KS-87E and KA-91C to accommodate optical filter changes.

**2.2.2.1 Measure.** SMT judgment of optical filter changeability in preparation for and during missions.

**2.2.2.2 Procedure.** The filters were changed on alternating KS-87E and KA-91C runs throughout the training sortie. The Wratten 25 filter was used for one "sensors on" period then changed to Wratten 12 for the next "sensors on" period. A TMT member observed the filter changes and administered a questionnaire to each SMT.

**2.2.2.3 Findings.** A total of three SMTs changed the filters and completed the questionnaire. Of these, one was very satisfied, one was satisfied, and one was dissatisfied with the capability. The reason for dissatisfaction was a problem area identified as a mission-degrading deficiency. This deficiency and an identified area of special satisfaction are as follows:

**2.2.2.3.1 Deficiency: S/C Switch on KS-87s Difficult to Access (DR FA4521960009).** Each KS-87E filter change requires resetting the s/c switch and this revealed a problem with the s/c switch location. To reset the s/c switch, the film magazine must be removed. The s/c switch is also close to the focal plane shutter which, in the unstable environment of flight, could easily be destroyed by a slip of the screwdriver being used to do the reset. The time required to remove and replace the magazine and the potential for damage to the focal plane shutter degrade mission accomplishment.

**2.2.2.3.2 Area of Special Satisfaction.** The overall consensus of the SMTs was that the modified KS-87E filter holders worked very well. They allowed the actual filter changes to be made quite easily.

**2.2.2.4 Conclusion.** The capability of the KS-87E must be improved to fully accommodate the optical filter change process.

**2.2.2.5 Recommendation.** Correct the mission-degrading deficiency identified by DR FA4521960009 (OPR: HQ ACC/DRFR; OCR: HQ ACC/DOYR).

**2.2.3 Objective 3.** Assess the capability of the CARA to be operated by the pilot, copilot, navigator, and DMC.

**2.2.3.1 Measure.** Pilot, copilot, navigator, and DMC judgment of CARA equipment operability (EO). EO is the capability of equipment (including subsystems and components) to be controlled by the operator in conducting the assigned mission tasks.

**2.2.3.2 Procedure.** The CARA was operated throughout the training sortie by the appropriate crew members. A TMT member observed the operation and administered a questionnaire to each of these crew members.

**2.2.3.3 Findings.** A total of eight crew members operated the CARA and completed the questionnaire. Of these, seven were very satisfied and one was satisfied with the capability. However, one problem was noted and identified as a mission-degrading deficiency. This deficiency and an identified area of special satisfaction are as follows:

**2.2.3.3.1. Deficiency: CARA Altitude Error (DR FA4521960007).** The aircraft altitude was changed frequently during the sortie. Crew members noticed the altitude displayed on the pilot CARA height display was consistently 200 feet lower than the altitude indicated on the copilot display throughout the altitude range of the sortie.

**2.2.3.3.2 Area of Special Satisfaction.** The overall consensus of the crew members was that the CARA is a good replacement for the radio altimeter and the light emitting diode (LED) readout was excellent for landing approach work.

**2.2.3.4 Conclusion.** The capability of the CARA to be operated by the pilot, copilot, navigator, and DMC supports completion of their mission tasks; however, the altitude error must be corrected.

**2.2.3.5 Recommendation.** Correct the mission-degrading deficiency identified by DR FA4521960007 (OPR: HQ ACC/DRFR; OCR: HQ ACC/DOYR).

**2.2.4 Objective 4.** Assess the capability of displays available at the flight-following station to present flight information to the DMC and FM.

**2.2.4.1 Measure.** DMC and FM judgment of the capability of the displays to present the required information in a usable form and to be viewed from the flight-following station seat.

**2.2.4.2 Procedure.** The flight-following station was manned and operated throughout the training sortie by the appropriate crew members. They tracked mission plan progress and recorded deviations. Deviations were required due to air traffic, weather, and restricted zone avoidance. These unforeseen events increased the realism of the training scenario. A TMT member observed the activity and administered a questionnaire to each crew member who manned the station.

**2.2.4.3 Findings.** A total of five crew members manned the station and completed the questionnaire. Of these, four were dissatisfied and one was very dissatisfied with the capability. The reasons for dissatisfaction were three problem areas identified as mission-degrading deficiencies. These deficiencies and an identified area of special satisfaction are as follows:

**2.2.4.3.1 Deficiency: Flight-Following Station Does Not Have a DARMS Display (DR FA4521960001).** As the sortie workload at the station accumulated, it became increasingly difficult for the DMC and the FM to keep up with their mission tasks and maintain situation awareness (SA) without a visual display. In order to adequately follow the intended flight path, maintain the proper corridor, observe exactly which sensors were operating and their configuration, observe actual present position, and be prepared to answer any questions raised by observed party members, the DMC and FM needed a DARMS display at their station. During the training sortie, they were frequently forced to turn 180 degrees to view the DARMS display at the SO station located across the aisle and directly behind them.

**2.2.4.3.2 Deficiency: Flight-Following Station Does Not Have a Magnetic Heading Indicator (DR FA4521960002).** A magnetic heading display was also needed at the flight-following station to improve SA. The only heading currently displayed is true heading and, when magnetic heading was needed, these data had to be manually converted.

**2.2.4.3.3 Deficiency: Flight-Following Station Does Not Have DARMS Data Access (DR FA4521960003).** The need for keyboard access to the DARMS at the flight-following station became evident before and during the training sortie because of the intensive workload produced by the mission plan. Navigation data, Digital Aeronautical Flight Information, and other related data bases are available in the DARMS but can be accessed only

from the SO station. When the DMC needed the information, he had to ask the LSO to call it up. The LSO can provide this assistance but only on a noninterference basis with his own duties.

**2.2.4.3.4 Area of Special Satisfaction.** Operators commended the addition of 115-VAC outlets and said the INS Remote Display Unit (RDU) was a real plus. They especially thought the RDU page 8 "frozen position" was a nice feature.

**2.2.4.4 Conclusion.** The capability of displays available at the flight-following station must be improved to fully support completion of DMC and FM mission tasks.

**2.2.4.5 Recommendation.** Correct the mission-degrading deficiencies identified by DRs FA4521960001, FA4521960002, and FA4521960003 (OPR: HQ ACC/DRFR; OCR: HQ ACC/DOYR).



**2.2.5 Objective 5.** Assess the capability of the sensor suite to be operated from the SO station.

**2.2.5.1 Measure.** LSO judgment of EO for each item in the sensor suite except the SAR. (The SAR was not on-line for the training sortie.)

**2.2.5.2 Procedure.** Each item in the sensor suite except the SAR was extensively operated from the SO station during the training sortie. A TMT member observed the operation and administered a questionnaire to each LSO.

**2.2.5.3 Findings.** A total of three LSOs operated the sensor suite and completed the questionnaire. Of these, one was satisfied and two were dissatisfied with the capability. The reasons for dissatisfaction were four problem areas identified as mission-degrading deficiencies. These deficiencies, enhancements recommended by the LSOs, and an identified area of special satisfaction are as follows:

**2.2.5.3.1 Deficiency: DARMS Does Not Display Correct Status of Cameras (DR FA4521960004).** When the KS-87Es or KA-91C were actually taking pictures, the indication on the DARMS was RDY (ready) rather than ON. This caused operator confusion and is expected to confuse onboard foreign observers.

**2.2.5.3.2 Deficiency: VLV Focal Length Not Fixed (DR FA4521960008).** The VLV camera has a variable focal length. This prevents establishment of a treaty mandated height/minimum (h/min).

**2.2.5.3.3 Deficiency: Video Control Panel Location Interferes With Mission Tasks (DR FA4521960011).** The layout of video controls, indications, and workspace was not optimized for completing LSO mission tasks. The video control panel is located to the left of the video monitor and caused physical interference during the training sortie. The LSO must use the small counter space in front of the video control panel to complete all of the required logs. In doing this, he can inadvertently bump the controls and alter their settings. Also, the LSO must move his logs to allow access to the video control switches. This can result in the LSO missing entry of important information into the mission logs.

**2.2.5.3.4 Deficiency: Default Focal Length Error for Oblique KS-87ES (DR FA4521960013).** An erroneous default value is programmed into the DARMS for both oblique-mounted KS-87Es. When the camera control panel was turned off to correct a malfunction, the DARMS defaulted to a 76-mm lens setting instead of the correct 152-mm value. The wrong default value was not evident until the next "sensors on" event. At that time, the sensor footprint displayed on the DARMS moving map display was

significantly larger than the area actually being imaged. This required extra time to correct, put erroneous data in the DARMS mission data log, and could be alarming to onboard foreign observers.

**2.2.5.3.5 Enhancement: DARMS Does Not Have Hot Key Access to Sensor Configuration Window (DR FA4521960019).** The DARMS provides hot key access to various control functions. This is very helpful to the operator and reduces the time necessary to update system information. The sensor configuration window is updated for every change in sensor, film, filter, magazine, etc. This window should have hot key access to reduce the impact currently experienced after configuration changes. The method of using mouse inputs is too time-consuming. Although the task was completed during the sortie using the current method, the process would be more convenient if a hot key capability was added.

**2.2.5.3.6 Enhancement: DARMS Magazine Inventory Difficult to Update (DR FA4521960020).** When film magazines are replenished and changed, the serial numbers of the new magazine and cassettes must be entered into the DARMS data base. If a new magazine is currently in the DARMS inventory, the data entry is done in the sensor configuration window. If the magazine had not been used previously on the aircraft, it must be entered into the inventory. The new magazine serial number cannot be entered from the sensor configuration window. A separate menu window must be used and this extra data entry sequence causes delays in getting the proper serial numbers into the data base. Although the task was completed during the sortie using the current sequence, the process would be more convenient if it could be done in fewer steps.

**2.2.5.3.7 Enhancement: DARMS/TOPS Weather Data Format Not Consistent (DR FA4521960023).** During each sensor event, weather data were called out by the aircrew and entered into the DARMS by the LSO. The order in which the weather data are entered is different from the weather data format for the Transportable Operational Planning System (TOPS). This caused confusion and delays when entering the data during sensor passes. Although the task was completed with the existing formats, the process would be more convenient if the formats were made consistent.

**2.2.5.3.8 Area of Special Satisfaction.** The overall consensus of the crew members was that the DARMS is a vast improvement over the IOC aircraft annotation system (Miletus) and provided heightened SA.

**2.2.5.4 Conclusion.** The capability of the sensor suite to be operated from the SO station must be improved to fully support completion of LSO mission tasks.

**2.2.5.5 Recommendation.** Correct the mission-degrading deficiencies identified by DRs FA4521960004, FA4521960008, FA4521960011, and FA4521960013, and provide the enhancements identified by DRs FA4521960019, FA4521960020, and FA4521960023 (OPR: HQ ACC/DRFR; OCR: HQ ACC/DOYR).

**2.2.6 Objective 6.** Assess the capability of displays available at the MC station to present mission information to the MC and other observers.

**2.2.6.1 Measure.** MC and other observer judgment of the capability of the displays to present the required information in a usable form and to be viewed from the MC seat and observer seats near the MC station.

**2.2.6.2 Procedure.** The MC station was manned and operated throughout the training sortie. The MC tracked mission plan progress, monitored mission parameters, and executed overall mission control from this position. A TMT member observed the activity and administered a questionnaire to each MC who manned the station.

**2.2.6.3 Findings.** A total of two MCs manned the station and completed the questionnaire. Of these, one was very satisfied and one was satisfied with the capability. Operators commented that the DARMS and video monitors at the MC station were outstanding and facilitated excellent mission following. They also stated that the radio capability was excellent. However, they noted a problem also observed by the LSOs. The DARMS did not display the true status of the KS-87Es and KA-91C when they were operating. As previously mentioned, this could confuse onboard foreign observers (DR FA4521960004).

**2.2.6.4 Conclusion.** The capability of displays available at the MC station supports completion of MC and other observer mission tasks; however, inaccurate presentation of KS-87E and KA-91C operating status must be corrected.

**2.2.6.5 Recommendation.** Correct the mission-degrading deficiency identified by DR FA4521960004 (OPR: HQ ACC/DRFR; OCR: HQ ACC/DOYR).

**2.2.7 Objective 8.** Assess the capability of onboard storage and temperature-conditioning equipment to maintain and prepare recording media for use.

**2.2.7.1 Measure.** SMT judgment of the capability of the media storage and temperature-conditioning equipment to support mission tasks.

**2.2.7.2 Procedure.** The media storage coolers were used before takeoff and during the training sortie. The temperature-conditioning equipment was not used due to temperate environmental conditions. A TMT member observed use of the coolers and administered a questionnaire to each SMT.

**2.2.7.3 Findings.** A total of three SMTs used the coolers and completed the questionnaire. Of these, two were satisfied with the capability and one was undecided. However, one problem area was noted and identified as a mission-degrading deficiency. This deficiency and enhancements recommended by the SMTs are as follows:

**2.2.7.3.1 Deficiency: Media Storage Insulating Blankets Interfere With Lid Closure (DR FA4521960014).** The insulating blanket on each media storage cooler completely covers the cooler exterior. The top cover which overlaps the sides interfered with closing the cooler lid. The extra care required to ensure a good seal took time away from other SMT tasks. The added time the lid was kept open or the seal integrity was breached caused the exact problem the blanket was designed to correct.

**2.2.7.3.2 Enhancement: Media Storage Rail Locking Pins Difficult to Insert (DR FA4521960018).** When the media storage coolers are pulled from the stowed position, a push-to-release (PIP) pin must be installed to keep the cooler from rolling back into the stowed position. The same pins are also used to keep the cooler in the stowed position. SMTs had difficulty during the sortie because the pin holes did not align properly. Alignment of the pin holes had to be forced in order to insert the pins. Although SMT tasks were completed under the current conditions, cooler operation would be more convenient if insertion of the pins was made easier.

**2.2.7.3.3 Enhancement: Missing Velcro on Media Storage (DR FA4521960024).** The insulating blanket on the media storage cooler below the media conditioner and the media conditioner itself did not have Velcro on the insulating blankets. Providing Velcro would help hold the cooler blankets in place.

**2.2.7.4 Conclusion.** The capability of the onboard media storage equipment must be improved to fully support completion of SMT mission tasks.

**2.2.7.5 Recommendation.** Correct the mission-degrading deficiency identified by DR FA4521960014 and provide the enhancements identified by DRs FA4521960018 and FA4521960024 (OPR: HQ ACC/DRFR; OCR: HQ ACC/DOYR).

**2.2.8 Objective 9.** Evaluate the timeliness of recorded media processing.

**2.2.8.1 Measure and Criterion.** The measure is the time required to process recorded media. The treaty criterion is that film-based media must be processed (to include creation of one copy) within 72 hours of arrival at the point of exit. There is no criterion for processing magnetic media.

**2.2.8.2 Procedure.** For the training sortie, the point of exit was designated as Wright-Patterson AFB. An OSMPF representative kept a time log on activity from delivery of exposed media to the OSMPF until all media were processed. The log was collected by a TMT member. The TMT member also observed a portion of the processing activity, and an OSIA image interpreter examined several samples of the finished product.

**2.2.8.3 Findings.** The OSMPF processed the film-based media within the required time limits. The total process for all media from delivery to finished product was completed in 44 hours. Additionally, the process was observed to be smooth and efficient, and no imagery degradations attributable to processing were found.

**2.2.8.4 Conclusions.** Media processing by the OSMPF meets user requirements.

**2.2.8.5 Recommendation.** None.

**2.2.9 Objective 10.** Assess the RMA of the sensor suite equipment and internal APU.

**2.2.9.1 Measure.** SMT judgment of RMA characteristics of each new or modified item in the sensor suite. (The internal APU was addressed in paragraph 2.2.1.)

**2.2.9.2 Procedure.** Each new or modified item in the sensor suite except the SAR was prepared for and/or operated during the training sortie. A TMT member observed the activity and administered a questionnaire to each participating SMT. The TMT made no attempt to calculate numeric values for RMA because of the small amount of operating time accumulated.

**2.2.9.3 Findings.** A total of three SMTs participated and completed the questionnaire. They noted five problem areas identified as mission-degrading deficiencies. These deficiencies are as follows:

**2.2.9.3.1 Deficiency: AAD-5 IRLS Magazine Guide Rails Missing (DR FA4521960010).** Prior to installation in the OC-135B, the IRLS had guides for both sides of the film magazine to ensure the magazine aligned properly in the recorder. The guides were removed for the Open Skies application. Without these guides, the magazine has only one pin and the floating electrical connector to aid alignment. This made insertion of the magazine difficult during the training sortie and likely will result in excessive wear or damage to the electrical connector. Also, without the guides, the magazine could not be aligned in exactly the same position each time it was inserted.

**2.2.9.3.2 Deficiency: Excessive Wear on KS-87E Film Magazine Cassettes (DR FA4521960012).** The film cassettes used in the KS-87E film magazines are very old and show signs of excessive wear. When used in the magazines (which had been reconditioned), the worn cassettes allowed slack in the film advance mechanism. During aircraft preflight, this slack caused a sensor fail indication at the LSO station.

**2.2.9.3.3 Deficiency: SMT Comm Box Failed (DR FA4521960015).** The communications boxes at the SMT seat positions failed. SMTs reported communications were garbled during previous flights. During the training sortie, one box failed completely and communications through the other became more garbled.

**2.2.9.3.4 Deficiency: Insufficient Number of KS-87E Film Magazine Cassettes (DR FA4521960016).** An insufficient number of film cassettes are available for use with the KS-87E film magazines. When using several film types during the training sortie, the lack of extra cassettes resulted in delays during film magazine changes. This, in turn, caused delays in "sensors on" time and in missed imaging.



**2.2.9.3.5 Deficiency: AAD-5 IRLS Vibration Isolators Too Soft (DR FA4521960017).** The vibration isolators used on the IRLS may be too soft. During low-altitude operations, the IRLS appeared to sway and bounce excessively on the isolators. This movement could degrade image quality and cause vibration damage to the IRLS.

**2.2.9.4 Conclusion.** The RMA of sensor suite equipment must be improved to fully support Open Skies observation mission requirements.

**2.2.9.5 Recommendation.** Correct the mission-degrading deficiencies identified by DRs FA4521960010, FA4521960012, FA4521960015, FA4521960016, and FA4521960017 (OPR: HQ ACC/DRFR; OCR: HQ ACC/DOYR).

## **2.3 PRIORITIZED DRs.**

**2.3.1 Prioritization.** The TMT prioritized the DRs after discussion of each item on a draft Deficiency/Enhancement List with training sortie crew members. The basic guideline used in prioritization was the beneficial effect correction would have on mission accomplishment. Tables 2-1 and 2-2 list the DRs by priority for resolution.

**2.3.2 Impact Summary.** If uncorrected, the deficiencies listed in Table 2-1 will have a serious impact on the capability of the OC-135B to support the Open Skies mission. Individually and in aggregate, they will degrade mission performance in a variety of ways including contributing to crew member workload saturation, loss of SA, misunderstandings by foreign observers, and suboptimization of collected observation data. The enhancements listed in Table 2-2 will have little or no impact on the mission if not implemented. Crew members can work around the inconveniences to complete mission tasks but at the expense of using extra time and energy.

## **2.4 OVERALL ASSESSMENT.**

**2.4.1** Questionnaire responses and debriefing comments from crew members indicated a high degree of satisfaction with the upgrade even under operating conditions that exceeded those expected on a typical Open Skies observation mission. Crew member compliments were noteworthy for the following areas:

**2.4.1.1** The MC station was praised as a well-designed area which will provide outstanding support to the OSIA and the Open Skies mission. The area facilitates flight following and has excellent radio capability.

**Table 2-1. Mission-degrading Deficiencies.**

Title	DR Number and Priority
Flight-Following Station Does Not Have a DARMS Display	FA4521960001
Flight-Following Station Does Not Have a Magnetic Heading Indicator	FA4521960002
Flight-Following Station Does Not Have DARMS Data Access	FA4521960003
DARMS Does Not Display Correct Status of Cameras	FA4521960004
APU Premature Shutdown	FA4521960005
APU Runs Too Hot	FA4521960006
CARA Altitude Error	FA4521960007
VLV Focal Length Not Fixed	FA4521960008
S/C Switch on KS-87Es Difficult to Access	FA4521960009
AAD-5 IRLS Magazine Guide Rails Missing	FA4521960010
Video Control Panel Location Interferes With Mission Tasks	FA4521960011
Excessive Wear on KS-87E Film Magazine Cassettes	FA4521960012
Default Focal Length Error for Oblique KS-87Es	FA4521960013
Media Storage Insulating Blankets Interfere With Lid Closure	FA4521960014
SMT Comm Box Failed	FA4521960015
Insufficient Number of KS-87E Film Magazine Cassettes	FA4521960016
AAD-5 IRLS Vibration Isolators Too Soft	FA4521960017

**Table 2-2. Recommended Enhancements.**

Title	DR Number and Priority
Media Storage Rail Locking Pins Difficult to Insert	FA4521960018
DARMS Does Not Have Hot Key Access to Sensor Configuration Window	FA4521960019
DARMS Magazine Inventory Difficult to Update	FA4521960020
Excessive Airflow Noise at High-Heat Settings	FA4521960021
Navigator Station Does Not Have a Bleed Air Light	FA4521960022
DARMS/TOPS Weather Data Format Not Consistent	FA4521960023
Missing Velcro on Media Storage	FA4521960024

**2.4.1.2** The DARMS was cited as a vast improvement over the Miletus system on the IOC aircraft. The DARMS provides heightened SA which is critical to mission accomplishment.

**2.4.1.3** The CARA was singled out as an improvement over the radio altimeter on the IOC aircraft. The LED readout was noted as having special utility.

2.4.1.4 The locations of 115-VAC power outlets were mentioned as an excellent design feature providing convenient power to operate carry-on equipment critical to mission accomplishment.

2.4.2 In addition to questionnaire responses, sortie debriefing discussions revealed that the crew members felt the modification was on track and would deliver a system they could use with pride worldwide.

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## SECTION 3 - CONCLUSIONS AND RECOMMENDATIONS

### 3.1 PRELIMINARY CONCLUSIONS.

#### 3.1.1 Overall.

3.1.1.1 The Phase II upgrade of the Open Skies OC-135B appears to be on track in satisfying user needs.

3.1.1.2 The identified mission-degrading deficiencies must be corrected to enable the Phase II upgrade to fully support the Open Skies observation mission.

#### 3.1.2 By Objective.

3.1.2.1 The capability of the internal APU must be improved to fully support OC-135B ground operations.

3.1.2.2 The capability of the KS-87E must be improved to fully accommodate the optical filter change process.

3.1.2.3 The capability of the CARA to be operated by the pilot, copilot, navigator, and DMC supports completion of their mission tasks; however, the altitude error must be corrected.

3.1.2.4 The capability of displays available at the flight-following station must be improved to fully support completion of DMC and FM mission tasks.

3.1.2.5 The capability of the sensor suite to be operated from the SO station must be improved to fully support completion of LSO mission tasks.

3.1.2.6 The capability of displays available at the MC station supports completion of MC and other observer mission tasks; however, inaccurate presentation of KS-87E and KA-91C operating status must be corrected.

3.1.2.7 The capability of the onboard media storage equipment must be improved to fully support completion of SMT mission tasks.

3.1.2.8 Media processing by the OSMPF meets user requirements.

3.1.2.9 The RMA of sensor suite equipment must be improved to fully support Open Skies observation mission requirements.

### **3.2 PRELIMINARY RECOMMENDATIONS.**

**3.2.1** Expeditiously correct the mission-degrading deficiencies identified by DRs FA4521960001 through FA4521960017 (OPR: HQ ACC/DRFR; OCR: HQ ACC/DOYR).

**3.2.2** Implement the enhancements identified by DRs FA4521960018 through FA4521960024 in the most timely and cost-effective manner practical (OPR: HQ ACC/DRFR; OCR: HQ ACC/DOYR).

**3.2.3** Continue operational testing of the OC-135B Open Skies Phase II upgrade as the aircraft becomes available (OPR: HQ ACC/DRFR; OCR: HQ ACC/DOYR).

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